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## (54) Exercising Apparatus

(57) A stand (1,7,13) for a bicycle (9) holds it with the rear wheel engaging a roller (22) and the user pedals against the resistance of a roller (22) governed to offer different levels of resistance at different stages in the programme. A variable power electric motor (21) may attempt to drive the roller against the drive from the bicycle and a counter (24) can register the roller revolutions to determine, by reference to a replaceable programme control element (25) what stage has been reached and hence the power to the motor. The same principles can be applied to other exercise machines not using bicycles or pedals.

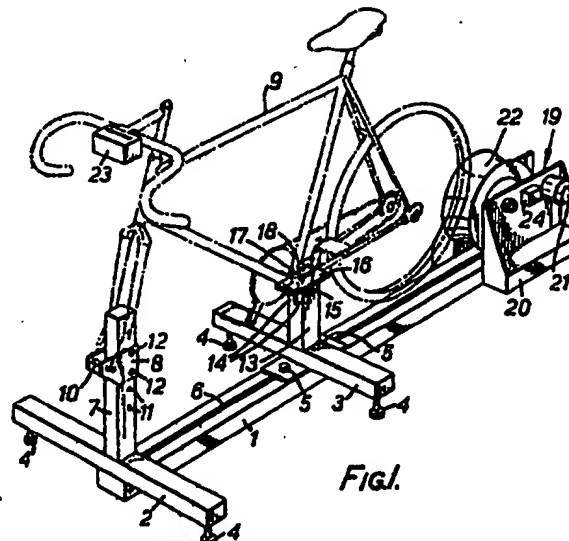


Fig. 1.

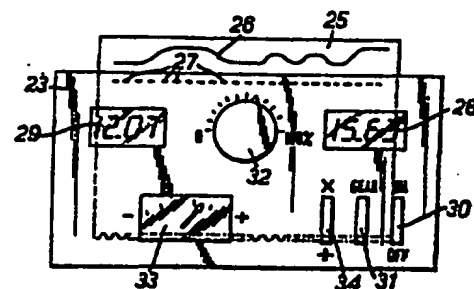


Fig. 2

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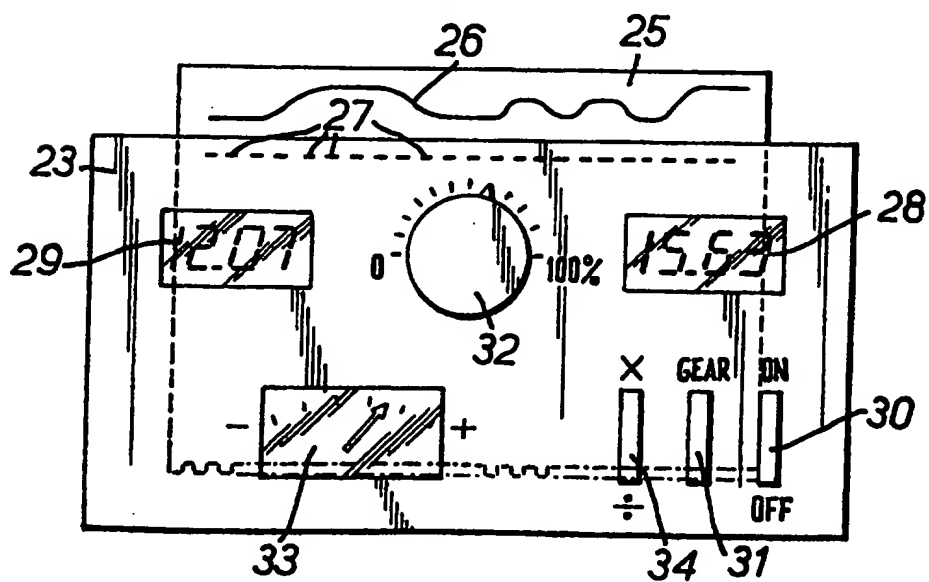
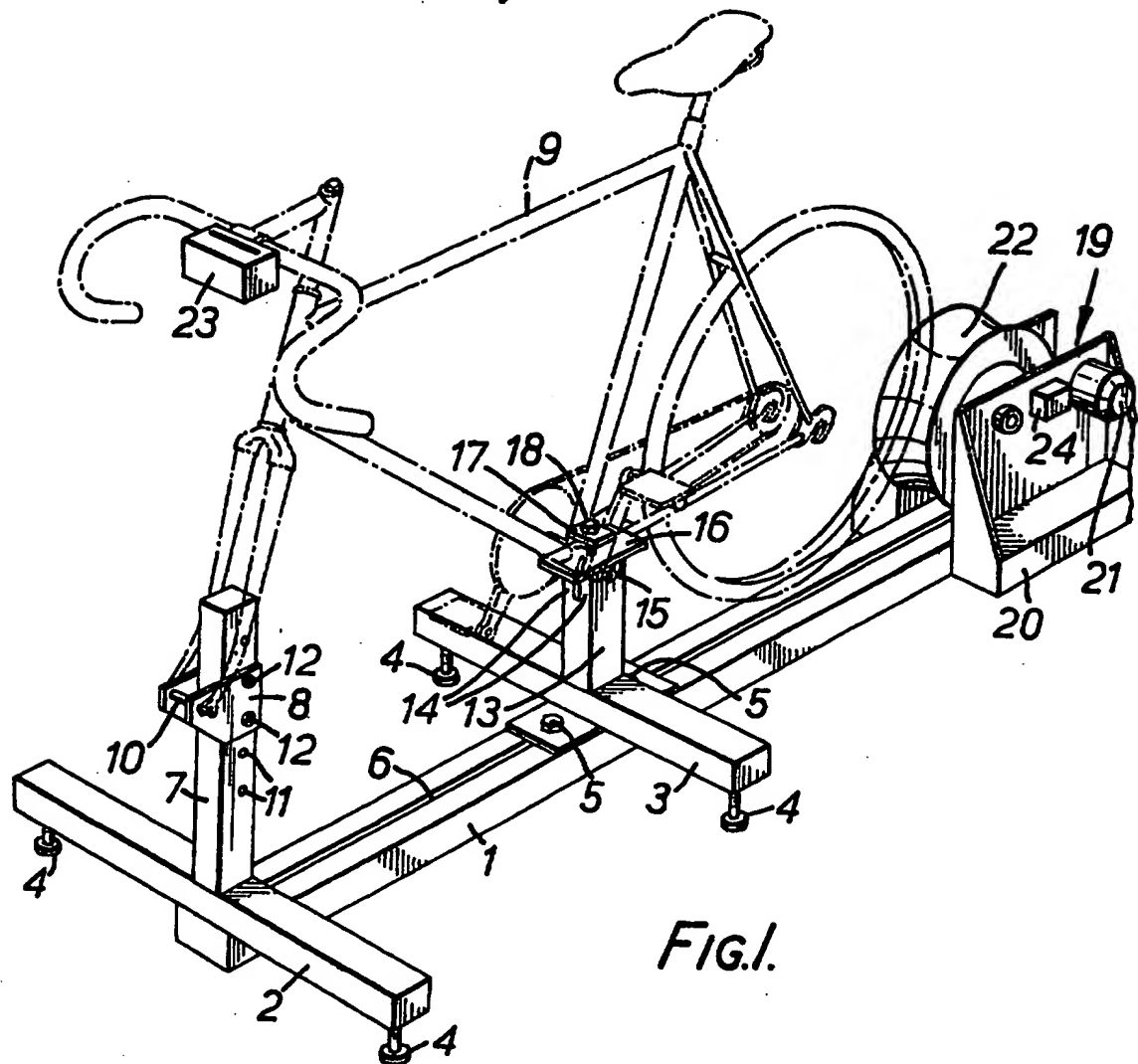


Fig. 2.

## SPECIFICATION

### Improvements relating to exercising apparatus

5 This invention relates to exercising apparatus.

Such apparatus commonly takes the form of a bicycle-like structure on which the user pedals against a fixed resistance for as long as he likes, or feels able to do. There are also rowing machines in

10 which the user pulls against springs.

These machines have the drawback that they only require the user to operate them according to his own ideas of what he should do to keep fit, and generally there are no means for encouraging

15 alterations in the work-rate. In other words, there are no variations in the resistance offered by the machine, simulating an actual ride on a bicycle for example.

It is recognised that a good training programme does have such variations; and also that it should be completed without cheating and give the person training an incentive not to give up when he feels like it.

It is the aim of this invention to provide training apparatus which can set a varied programme whose speed of accomplishment depends on the user's fitness, but which does demand that even the least fit should press on until it is finished. It may be applicable not only to athletes in training, but also to

30 physiotherapy patients.

According to the present invention there is provided exercising apparatus comprising means for providing a programmed resistance to muscular activity, means for monitoring the extent by which

35 that resistance is overcome, and means for progressing the programme in accordance with said extent.

Thus the more work is expended on it in the shorter time, the quicker the programme may be completed.

40 The programme may provide a uniform or variable resistance.

Conveniently, the resistance may be derived from an electric motor whose windings are energised at a level or levels according to the programme, the

45 muscular action being arranged to oppose the rotation of the motor. This rotation, or that of a member coupled to the motor, may provide a pulse train or other signal that can be used to govern the progress of the programme. Thus if the user is

50 barely overcoming the motor there will be a slow pulse train and a corresponding lack of programme advance, which will tend to drag on interminably unless more effort is put in.

Preferably, there is a display and control unit for

55 indicating to the user the progress he is making, for example in terms of speed, effort and relative performance to a standard. His point of advance along the programme can also be shown. There may be controls for modifying a selected programme.

60 In one preferred form the apparatus takes the form of a stand for a bicycle, which holds it upright with the driving wheel acting against a roller coupled to

embodiment thereof will now be described, by way of example, with reference to the accompanying drawing, in which:

70 *Figure 1* is a perspective view of a bicycle exercising apparatus, and

*Figure 2* is a diagrammatic front view of a display unit, partly cut away.

The apparatus of *Figure 1* comprises a longitudinal base 1 with two cross-members 2, 3 secured beneath

75 it and having at their ends adjustable feet 4. The cross-member 2 is fixed at one end (the forward end) while the cross-member 3 may be adjusted longitudinally and secured at the desired position by a clamping nut assembly 5 co-operating with longitudinal groove 6.

A first pillar 7 with a bracket 8 nears its upper end is provided at the forward end to support the front fork of a bicycle 9 having had its front wheel removed. Such removal is generally a quick and

85 easy operation. The bracket has a substitute spindle 10 and is adjustable in height to cater for different bicycles, the pillar 7 being provided with an array of holes 11 from which to select for the bracket holding bolts 12.

90 A second pillar 13 is upstanding from the centre of the cross-member 3 to support the main frame of the bicycle below the pedal spindle. At its upper end the pillar 13 is bifurcated in the longitudinal direction to provide vice-like jaws 14 which can be tightened together by a screw 15. A small platform 16 has a central, downwardly extending tongue which can be slotted between the jaws 14 and clamped there. This enables minor longitudinal adjustment without moving the cross-member 3. Another clamp is provided

100 by a plate 17 and a vertical bolt 18 which co-operates with the platform 16. In use, the bicycle rests on the platform and the clamping plate 17 is tightened down onto the root ends of the lower arms of the rear wheel fork. Generally this pillar 13 will not

105 require height adjustment, although it could be provided. When mounted on the pillars 7 and 13, the rear wheel of the bicycle should be clear of the ground or the base 1.

An energy-absorbing/resistance-providing device

110 19 can be brought into co-operation with the rear bicycle wheel. It comprises a base 20 which straddles the base 1 and which can be moved longitudinally thereof, an electric motor 21 and a flywheel-roller 22 driven by the motor via a timing belt drive or chain (not shown). The base 20 need not be secured to the base 1 - its own weight may be sufficient to keep it in place - although there could be clamping means. The motor 21 will generally be small, of ½ h.p. say, and energisable from an ordinary domestic mains supply. However, the amount of energisation is under the control of a programme inserted into a display unit 23 that is clipped or otherwise attached to the handle-bars of the bicycle. In use, the rear wheel of the bicycle

125 engages and rotates the roller, whose inertia smooths out the pumping action of the pedals.

The embodiment described has the advantage of being able to accept almost any bicycle and is not a

pillar, one part each side, with means for supporting the bicycle by its handle-bars. It would also be possible to rest the rear wheel on one or a pair of idler rollers. The resistance roller 22 could also be re-positioned to play a more active supporting role, although to avoid raising the bicycle too high it would have to be reduced in size and possibly be coupled to a separate flywheel.

The motor 21 and roller 22 have a pulse generator 24 associated with them to produce a train of pulses whose frequency is directly related to the speed of the motor and roller. When energised, partly or fully, the motor turns, or attempts to turn, the roller 22 in opposition to the direction in which that roller is turned when the bicycle is being pedalled. Therefore, the pulse train is an indication of how fast the bicycle is going in the face of the resistance offered by the motor. conveniently, the circumference of the roller 22 is one metre and a single pulse per revolution is obtained by optical or other means. The pulse count is therefore a direct indication of distance travelled, and speed is also readily derived.

A programme is diagrammatically illustrated in Figure 2, and it takes the form of a card 25 that slots into the unit 23, leaving an edge projecting with a gradient profile 26 of the route to be cycled. The opposite edge is toothed and the teeth are counted from one end electronically synchronously with the pulse train from the motor 10. Other digital markings are possible. At intervals along the length of the toothed edge the pulse count determines the adjustment, or the switching into or out of circuit of components such as resistors, attached to or forming part of the card.

These are part of an electronic control circuit (not shown) which governs the amount of energisation of the windings of the motor 21. Thus a high electrical resistance may be arranged to energise the windings fully and create the maximum resistance offered by the roller 22 to the cyclist. A lower electrical resistance, or none at all, would reduce the mechanical resistance and offer "easy" spells.

The pulse count from the generator 24 directly governs the progress along the programme route. It will therefore be seen that such progress is only achieved by overcoming the retarding motor 21, and the greater the extent by which this can be done, the quicker the programme can be completed. A fit person will therefore complete his exercise before an unfit one, but there will be every inducement for the unfit person to battle on and complete the programme.

The display unit 23 has an array of LED's 27 to indicate the progress along the programme route, a speed indicator 28, and a clock 29 showing the time taken. There is also an on/off switch 30 and a change gear switch 31. The latter, when operated, switches off the power to the motor and suspends the pulse count, but does not affect the clock. The reason for this is that an easier and smoother gear change, more like that obtained under real road conditions, is achieved when the cyclist is not pedalling hard. Thus temporary operation of this switch realises only

a distance. A full programme from a card 25 may not be required and a section only might be set. Instead of a variable gradient, a level stretch might be set using this knob and no card. The distance travelled could still be indicated by the LED's or there could be another dial or window showing this parameter.

Various other displays can be incorporated. For example, there could be means giving a comparison either with a previously completed programme or with an accepted par. It might be recognised that a fit person would have reached a particular point in a particular time, and the display unit could show by moving needle indicators 33, or by lights for example, whether the current user is beating that or lagging behind. There may also be displays of the maximum speed achieved and the equivalent gradient being attempted, although that is normally apparent from the card profile and the LED's 27.

There may be facility for altering the rate of progress of a programme, for example by multiplying or dividing the pulse count, this factor being introduced by a switch 34 on the display unit. It will be understood that various programmes can be inserted, and there may be a set of programmes to be used in order of difficulty, gradually to bring a user to peak-fitness.

It will be appreciated that similar principles can be applied to other exercising machines. For example, in a rowing machine the oars may be arranged to work a rotary member which is variably retarded by an electric motor in a similar way.

Although electric retardation is preferred, the same results could be achieved by hydraulic or pneumatic means, or even purely mechanically.

## CLAIMS

1. Exercising apparatus comprising means for providing a programmed resistance to muscular activity, means for monitoring the extent by which that resistance is overcome, and means for progressing the programme in accordance with said extent.

2. Apparatus as claimed in claim 1, wherein the programme provides a uniform resistance.

3. Apparatus as claimed in claim 1, wherein the programme provides a variable resistance.

4. Apparatus as claimed in claim 1, 2 or 3, wherein said resistance is provided by a motor driving a member arranged to be driven in the opposite sense by said muscular activity.

5. Apparatus as claimed in claim 4, wherein the monitoring means includes pulse generating means responsive to the resultant drive of said member.

6. Apparatus as claimed in claim 5, wherein the programme has associated digital means countable by the pulses from said generating means to determine the progress of said programme.

7. Apparatus as claimed in claim 6 as appendant to claim 3, wherein the motor has control means to vary its power, and the pulse count of said digital means is arranged to govern said control means.

8. Apparatus as claimed in claim 7, wherein the control means is electronic and components thereof

9. Apparatus as claimed in claim 8, wherein the programme is replaceable with other programmes, each taking the form of an element bearing said digital means and components individual, or individually arranged, to that programme, and each element being co-operable with a unit containing further components of said control means.
10. Apparatus as claimed in any preceding claim, wherein there are means for indicating progress of said programme.
11. Apparatus as claimed in claims 9 and 10, wherein each replaceable element has an illustration of the programme, and said means for indicating progress co-operate with said illustration.
12. Apparatus as claimed in any preceding claim, including means for applying a multiplying or dividing factor to the programmed resistance.
13. Apparatus as claimed in any preceding claim, including means for curtailing or using only a portion of the programme.
14. Apparatus as claimed in any preceding claim, wherein there is a variable transmission between the applied muscular activity and the resistance, and wherein means are provided for relieving the resistance and nullifying the progressing means while the transmission is varied.
15. Apparatus as claimed in any preceding claim, including a stand adapted to hold a bicycle with its driving wheel against a rotary member to which said resistance is applied.
16. Exercising apparatus substantially as hereinbefore described with reference to the accompanying drawings.